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How are Canadian Regions Adjusting to a Larger and More Integrated North American Market?

by Wulong Gu and Gary D. Sawchuk

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Abstract

This paper relates to two understudied, but increasingly important concerns: the measurement of regional integration, and the regional benefits to North American economic integration. The objective is to measure Canada's regional integration in manufacturing industries with that of the United States, and examine the regional impact of growing trade integration on productivity growth and select other economic performance variables.

Our research shows that Canada and each of its regions are becoming more integrated in trade in manufactures with the United States—but Ontario is much more integrated than the rest of Canada. While all regions have benefited through improved productivity performance, higher wages and higher output growth, Ontario has been the principal beneficiary. No evidence was found that increased trade integration in manufactures with the United States caused anything more than short-run adjustment losses in employment. Canada and each of its regions have expanded their share of North American manufacturing which stands in sharp contrast to the supposition that it would be the United States that would experience a growth in North American production share (Krugman, 1980).

Keywords: adjustment, trade integration, economic performance

JEL: F1, F15, R1

Executive summary

This paper relates to two understudied, but increasingly important concerns: the measurement of regional integration, and the regional benefits to North American economic integration. The Canada-U.S. Free Trade Agreement (FTA) and the North American Free Trade Agreement (NAFTA) provided Canada and all of its regions with better access to the large North American market. However, recent research for Canada on the impact of tariff reductions is incomplete by not addressing how widespread these resultant benefits are across regions, which can be crucial considerations in public policy debates.

Consequently, the objective of this study is to empirically measure trade integration in manufactures between Canada's regions and the United States, and to examine the regional impact of growing trade integration—specifically focusing on output and employment growth and productivity performance. We also examine how increased trade integration has impacted on Canada's share of North American production, and those shares of individual Canadian regions.

We ask four questions in the paper.

1) First, are there differences in trade integration with the United States across Canadian regions?

Our research shows that Canada and each of its regions are becoming more integrated in trade in manufactures with the United States—but Ontario is much more integrated than the rest of Canada. Atlantic Canada is the least integrated, while Quebec and Western Canada are in-between. We find that this is mostly due to individual industries across regions being differently integrated with the United States, as opposed to regions just having dissimilar industrial structure in manufacturing.

For Canada and all of its regions, the pace towards deeper integration with U.S. manufacturing was faster after the implementation of the FTA. Again, however, the pace has been much faster in Ontario. When we decompose changes in trade integration into changes in import and export intensities, we find that differences in import growth have been the main source of regional differences in the pace of trade integration with the United States. Changes in regional exports (relative to total shipments) are similar across the regions.

2) Second, are there differences in the impact of trade integration on productivity growth across Canadian regions?

While all regions have benefited from deepening trade linkages with the United States, Ontario has been the principal beneficiary. Our calculations show that deepening trade integration with the United States was associated with higher multifactor productivity (MFP) growth of 1.2% per year for manufacturing in Ontario over the 1988 to 1999 period. In other regions, the impact is rather small—higher manufacturing multifactor productivity of 0.4% per year for Quebec, 0.3% for Western Canada and 0.2% for Atlantic Canada. The story is similar for labour productivity growth.

Our analysis suggests that part of these productivity gains was passed on to workers in the form of higher wages. When we calculated the impact of increased trade integration on real wage growth, we find that workers in Ontario gained the most from increased trade integration. The gains in other regions, although significant, were relatively minute. Over the 1988 to 1999 period, increased trade integration was associated with real wage gains for manufacturing workers of 12.0% for Ontario, but only 1.0% for Quebec, 0.8% for Western Canada, and 0.4% in Atlantic Canada.

3) Third, what is the effect of trade integration with the United States on output growth and employment growth?

Our evidence suggests that manufacturing output growth for Ontario was strongly linked to increased trade integration in manufactures with the United States. Increased trade in manufactures with the United States was associated with annual increases in Ontario's real value added in manufacturing that totalled 11.1% over the 1988 to 1999 period. For other regions, the impact was considerably less—measuring 3.5% for Quebec, 2.9% for the Prairies, 2.8% for British Columbia, and only 1.8% for Atlantic Canada.

No evidence was found that increased trade integration in manufactures with the United States caused anything more than short-run adjustment losses in employment. Indeed, by 2001, manufacturing employment had already bounced past pre-FTA levels.

4) Fourth, did Canadian regions lose their share of North American manufacturing as a result of deepening trade integration with the United States?

There was a concern among some in Canada that an increase in trade integration would lead to a decline in Canada's share of North American shipments as firms relocated to the larger U.S. market.

Our evidence provides little support for the concern. We find that Canada and each of its regions have expanded their share of North American manufacturing during the 1980s and 1990s, with Ontario's share increasing by far the fastest, followed by modest increases for the Prairies and Quebec, and smaller gains by British Columbia and Atlantic Canada.

1. Introduction

The Canada-U.S. Free Trade Agreement (FTA), which was implemented in 1989, and the subsequent North American Free Trade Agreement (NAFTA), which came into force in 1994, have provided Canada and all of its regions with better access to the large North American market. Earlier research suggests that increased integration with the United States has resulted in positive adjustments that have resulted in significant economic benefits for Canadian manufacturing—through higher output growth and improved industrial productivity performance (Trefler, 2004; Baldwin, Caves and Gu, 2005; Gu, Sawchuk and Rennison, 2003).

The objective of this paper is to examine regional differences in Canada's trade integration in manufactures with the United States, and to investigate how Canada's regions are adjusting to and benefiting from a more integrated North American marketplace. The paper poses two questions. First, have all regions experienced greater trade integration in manufactures with the United States? Second, what has been the impact of increased Canada-U.S. trade integration in manufactures on Canada's regional economies?

Little empirical work has examined the relative strength of trade integration in manufactures between individual Canadian regions and the United States.[1] What's more, no previous study, to our knowledge, has examined the issue of whether the impact of trade integration on economic performance differs across Canadian regions. This paper explores these differences, and, along the way, makes a number of contributions to the growing literature on the measurement and analysis of increased economic integration.

First, we construct an index of trade integration that is appropriate for examining the trade integration of small open economies such as Canada and its individual regions with the United States. The index of trade integration is derived from models of trade in differentiated products, and is constructed from a database containing bilateral trade and production data.

Second, and unlike most previous studies that focus on the effects of tariffs, we use a measure that is affected by tariff and what might be broadly referred to as other, non-tariff, trade barriers. The latter includes transportation costs, border risks and additional factors (such as government policies) that favour domestically-produced goods. Non-tariff barriers in the form of border risks have become more important after the terrorist attack of September 11, 2001 in the United States. It is therefore essential to account for these non-tariff barriers in measuring the overall barriers to trade between Canada and the United States in manufactures.

Third, we depart from previous studies that assume that industry-level trade barriers are the same across all regions. While Canada-U.S. tariff barriers are similar among Canadian regions, there are large differences in other trade barriers. Overall trade barriers facing Ontario's manufacturers are much lower than barriers facing manufacturers in other regions.

1. Gu and Sawchuk (2001) have examined regional differences in trade integration and find that all Canadian regions except British Columbia increased their trade linkages in manufacturing with U.S. markets between 1990 and 1998.

Fourth, we examine different effects that Canada-U.S. trade integration has had on Canada's individual regions—specifically focusing on output and employment growth and productivity performance. We also examine how increased trade integration has impacted on Canada's share of North American production, and those shares of individual Canadian regions.

The study finds that while Canada and each of its regions are becoming more integrated in trade in manufactures with the United States, some regions are much more integrated, and the regional impacts of this increased trade integration are quite varied. Indeed, the results in the paper show that the two-way integration between Ontario and the United States is much greater than that between the United States and the rest of Canada. Atlantic Canada is the least integrated, while Quebec and Western Canada are in-between. The pace towards deeper integration with the United States is also much faster in Ontario than for the rest of Canada.

The impact of trade integration on productivity performance (in respect to both labour productivity growth and multifactor productivity growth) is largest for Ontario. In other regions, the impact is rather small. Our calculations show that deepening trade integration with the United States was associated with increases in multifactor productivity (MFP) of 1.2% per year for manufacturing in Ontario over the 1988 to 1999 period. It was associated with increases of manufacturing MFP of 0.4% per year for Quebec, 0.3% for Western Canada and 0.2% for Atlantic Canada.

The results in the paper also show that deepening integration with the United States was not associated with a permanent loss in manufacturing employment, nor did it result in a decline in Canada's share of North American manufacturing. Actually, Canada and each of its regions expanded their share of North American manufacturing.

In the following section, we provide a brief review of previous studies on trade integration and economic performance. In Section 3, we present an index of trade integration that is derived from models of trade in differentiated products, and show how to estimate the measure using bilateral trade and production data for the United States, Canada, and individual Canadian regions. In Section 4, we discuss the data sources for our analysis. In Section 5, we present our empirical results on the impacts of increased trade integration in manufactures with the United States for Canada and each of its regions. Section 6 concludes the paper.

2. *A review of literature on trade integration and economic performance*

A large number of studies have examined the trend in Canada-U.S trade integration and its implications for Canada's overall economic performance. In this section, we first review the literature on the measurement of trade integration between the two countries. We then summarize studies that look at the implications of increased integration for Canada's economic performance.

Most previous studies find that there was a significantly large increase in trade between Canada and the United States as a result of the Canada–U.S. Free Trade Agreement and the North American Free Trade Agreement.[2] The trend in Canada-U.S. trade suggests a long-term tendency towards deeper integration that increased its pace during the 1990s around the times of the Canada-U.S. FTA and NAFTA.

Following seminal pieces on Canada-U.S. border effects by McCallum (1995) and Helliwell (1996a), a large number of studies used internal Canadian trade to benchmark trade barriers between the two North American countries. While finding that the Canada-U.S. border still represents a significant impediment to international trade, these subsequent studies also showed large declines in the border barrier during the 1990s, indicating that further trade integration was occurring between Canada and the United States (e.g., Helliwell, Lee and Messinger, 1999; Coulombe, 2005).

The trend toward deeper integration with the United States has been shown to vary across Canadian regions. Gu and Sawchuk (2001) find that in the 1990s, the fastest rise in Canada's regional trade integration in manufactures with the United States occurred in Ontario, while smaller increases occurred in other regions, except in British Columbia where trade linkages in manufactures with the United States actually showed no significant increase. Brown and Anderson (1999) investigated trade flows between Canadian provinces and U.S. states to explore the regional structure of Canada-U.S. trade. They find that trade can be quite strong between regions with similar industrial structure, but this trade tends to be limited to regions in close geographic proximity. As the distance between regions increases, trade based on different but complementary industrial structures becomes dominant.[3]

What are the implications of increased Canada-U.S. trade integration in manufactures for economic performance in Canada? The issue has been addressed in a number of recent papers. Trefler (2004), and Sawchuk and Trefler (2002) show that the FTA tariff cuts generated large productivity gains in Canadian manufacturing. Trefler (2004) finds that Canadian tariff cuts raised labour productivity by 15% for industries subject to large tariff cuts. U.S. tariff cuts raised labour productivity by 14%. Balanced against these long-run productivity gains are large short-run adjustment costs. For industries subject to large Canadian tariff cuts, the short-run costs included a 12% decline in employment. Sawchuk and Trefler (2002) concluded that the FTA explained 4.7 percentage points or one-quarter of the 20 percentage-point increase in labour productivity in Canadian manufacturing over the 1988 to 1996 period.[4]

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2. One possible exception is the paper by Globerman and Storer (2003) that uses various price-based and quantity-based indicators of economic integration. While the results show modest evidence of incremental integration in the post-FTA period, the paper finds that the observed pattern of integration is not obviously related to the implementation of the FTA. It suggests Canada's flexible exchange rate regime and increased exchange rate volatility as mitigating factors.
3. In these studies, the 'northern state bias' has been a widely recognized problem, where trade data to the northern states may reflect some export trans-shipments to other states and beyond. Similarly, goods originating elsewhere in Canada but crossing the border, for instance in Ontario, may be reflected in Ontario's data. These phenomena should continue to be further researched.
4. Bernard et al. (2002) examined the effect of tariff reductions on productivity growth in U.S. manufacturing. They found that productivity growth was faster in industries with falling tariff and freight costs.

A number of recent studies have examined the sources of these FTA-induced productivity gains that include changes in firm size and scale economies, changes in product diversification/ specialization, the exit of least productive plants, and changes in plants' export-participation. Head and Ries (1999), Gu, Sawchuk and Rennison (2003) and Trefler (2004) have examined the effect of tariff reductions on plant size and firm size. These studies find no evidence in support of the view that trade liberalization would increase plant scale and firm size. Baldwin, Beckstead and Caves (2002) and Baldwin, Caves and Gu (2005) find that tariff reductions are linked to a decline in the product diversification of Canadian manufacturing plants. Access to the large U.S. market has allowed Canadian plants to increase product specialization and achieve economies of large-scale production.

Several studies have also examined the exit of the least productive firms and plants as a source of productivity gains from trade liberalization. Head and Ries (1999) provide evidence that the FTA induced substantial rationalization within Canadian manufacturing through a decline in the number of plants. Gu, Sawchuk and Rennison (2003) finds that the FTA tariff reductions exposed firms to increased global competition, which drove out less efficient firms. Baggs (2004) exhibits how Canadian tariff cuts are linked to the decline in the survival of Canadian manufacturing firms. Baldwin and Gu (2004) have examined the impact of tariff reductions on the export participation of Canadian manufacturing plants and find that more manufacturing plants start exporting as tariffs fall in Canada. As exporters learn from international best practices and improve productivity, the increase in export participation constitutes an important source of gains from trade liberalization.

Head and Ries (2001) have examined the implication of the trade integration for Canada's share of North American production. The potential loss in Canada's share of North American production as a result of trade integration has been a main concern for both opponents and supporters of trade liberalization. Krugman (1980) shows that a large home market for a product translates to a disproportionate share of output. A reduction of trade barriers between Canada and the United States should cause firms to relocate to the larger U.S. market and serve the smaller Canadian market through exports (the so-called home-market effect). In contrast to research by Davis and Weinstein (2003), who report a strong home-market effect among OECD countries, Head and Ries (2001) find little support for the home-market effect in the Canada–U.S. context. Instead, they find that the trade liberalization in the 1990s favoured Canadian industries facing small U.S. demand over industries facing large U.S. demands.

Although the above studies provide an altogether rich, insightful and varied discussion on the implications of increased trade integration, none focus on sub-national differences in the implication of trade integration for economic performance. Rather, these studies all spotlight on Canada as a whole, or other countries. However, there are meaningful differences in the industrial structures of Canada's regions, and important differences in the size and make-up of regional manufacturing. Often the nature of individual industries also varies as one moves across the country, as do the nature of regional trade linkages with the United States. As such, there is a need to better understand Canada's regional experience with trade integration in manufactures with the United States. This includes the development of a suitable measure to investigate how Canada's trade integration in manufactures with the United States may impact differently on Canada's regional economies.

3. *Measuring Canada's regional integration with the United States*

A variety of measures have been used in empirical studies to measure trade integration. These measures include: ratios of imports, exports, total trade or intra-industry trade to output (either total value-added or total shipments); tariff rates; and actual trade relative to potential trade volume.

While useful, these measures of trade integration often lack theoretical foundations. To overcome this weakness, a number of recent studies have developed an alternative measure that is derived from the economic model of international trade in differentiated products with trade costs (Head and Mayer, 2004; and Anderson and van Wincoop, 2004). In the next subsection, we present this measure. We then propose a variant for estimating regional impacts of Canada-U.S. trade integration in manufactures.

3.1 Deriving the trade integration measure

Following Head and Mayer (2004), consider trade between two countries, i and j. Let $u_j Y_j$ denote expenditures by region j on a representative industry, where u_j is the industry's expenditure share and Y_j is total expenditures in the country.[5]

The industry in country i produces n_i product varieties, and the industry in country j produces n_j product varieties for a total of $n_i + n_j$ product varieties. The consumers in the two countries have identical, homothetic preferences, approximated by a constant elasticity of substitution (CES) function of differentiated varieties produced in the two countries.

The amount spent by consumers from country i for a representative variety produced in country j is given by

$$(1) \qquad p_{ij} q_{ij} = \frac{p_{ij}^{1-\sigma}}{\sum_k n_k p_{ik}^{1-\sigma}} u_i Y_i ,$$

where q_{ij} denotes the demand by consumers in country i for a representative variety from country j, σ is the elasticity of substitution between product varieties, and p_{ij} is the delivered price faced by consumers in country i for products from j. It is the product of the mill price p_j and trade cost τ_{ij} paid by country i's consumers. Trade costs are broadly defined to include all costs incurred in getting the good to a final user other than the production cost itself. This includes transportation costs, policy barriers (tariff and non-tariff barriers), information costs, contract enforcement costs, costs associated with the use of different currencies, legal and

5. This fixed-share expenditure pattern can be derived from a Cobb-Douglas, a function of utility derived from the consumption of goods from various industries.

regulatory barriers, and local distribution costs (Anderson and van Wincoop, 2004). It also includes the "home bias" of consumers.
The total value of imports of all n_j product varieties from country j can be written as

$$(2) \qquad m_{ij} = n_j p_{ij} q_{ij} = n_j p_j^{1-\sigma} \phi_{ij} u_i Y_i P_i^{\sigma-1},$$

where $P_i = \left(\sum_j n_j p_j^{1-\sigma} \phi_{ij} \right)^{1/1-\sigma}$ is the overall price index in country i, and $\phi_{ij} = \tau_{ij}^{1-\sigma}$. ϕ_{ij} can be interpreted as a measure of trade openness or trade integration between the two countries. There is a negative relationship between ϕ_{ij} and trade barriers τ_{ij} as $\sigma > 1$. As trade costs decline, and the two countries become more integrated in trade, the index of trade integration also increases.

Equation (2) can be manipulated to yield the following results

$$(3) \qquad \frac{m_{ij} m_{ji}}{m_{ii} m_{jj}} = \frac{\phi_{ij} \phi_{ji}}{\phi_{ii} \phi_{jj}}.$$

A standard practice in the literature is to assume free trade within countries, i.e., $\phi_{ii} = \phi_{jj} = 1$ and symmetric trade costs $\phi_{ij} = \phi_{ji}$. If we make the assumption, the index of trade integration between the two countries, from the perspective of the two countries each with the other, can be estimated from data on bilateral trade and production

$$(4) \qquad \phi_{ij} = \sqrt{\frac{m_{ij}}{m_{ii}} \frac{m_{ji}}{m_{jj}}}.$$

That is, the index of trade integration is a geometric mean of imports/domestic purchases ratios in the two countries, m_{ij}/m_{ii} and m_{ji}/m_{jj}, where domestic purchases or "imports from self" within a country can be calculated as a difference between shipments and exports. This measure of trade openness between the two countries can be further decomposed into constituent parts that show the relative importance of each individual country's exports and imports with the other country. That is, the measure can be expressed in terms of the geometric average of the export and import intensities of the two countries, (m_{ij}/m_{ii}) x (m_{ji}/m_{ii}) and (m_{ij}/m_{jj}) x (m_{ji}/m_{jj}), where such are defined as each country's bilateral exports and imports divided by its domestic purchases.[6]

Empirical studies have also used the ratio of intra-industry trade to shipment, which is defined as $2\min(m_{ij}, m_{ji})/y_i$, where y_i denotes total shipments of country i. This measure is related to the measures (Equations 4 and 5) that we use in the paper. The two measures have a maximum value for any specific level of trade when the value of exports equal the value of imports $m_{ij} = m_{ji}$, and have a minimum when either the value of imports or the value of exports is zero.

6. That is $\phi_{ij} = [\sqrt{(m_{ij}/m_{ii}) \cdot (m_{ji}/m_{ii})} \cdot \sqrt{(m_{ij}/m_{jj}) \cdot (m_{ji}/m_{jj})}]^{1/2}$.

3.2 Estimating a Canada-U.S. integration measure for Canada's regions

In a small open economy such as Canada, a large portion of shipments is destined abroad. When we calculate the purchase of Canadian goods (m_{ii}) as the difference between Canadian shipments and Canadian world exports, we discover that the resulting estimates are quite volatile at the regional and industrial levels. This is due, in part, to the fact that the data on shipments and expo[illegible] are calculated from different sources. Shipments are estimated from an establishment survey (Statistics Canada's Annual Survey of Manufactures); whereas the exports data are derived from customs documents. Consequently, a variety of complications and measurement errors arise based on dissimilar industry classifications, valuations, etc.[7] To overcome these measurement errors, we use a variant of the above trade integration measure for our analysis. This index of trade integration between two regions $\tilde{\phi}_{ij}$ will be estimated as a geometric mean of imports/shipment ratios in two regions

$$(5) \qquad \tilde{\phi}_{ij} = \sqrt{\frac{m_{ij}}{y_i}\frac{m_{ji}}{y_j}} \ ,$$

where y_i, y_j denote total shipments in two regions.[8]

Our choice of trade integration measure reflects a compromise between theoretical and empirical considerations. The variant of trade integration in equation (5) is related to the original measure by equation $\tilde{\phi}_{ij} = \phi_{ij}\sqrt{r_i r_j}$, where r_i is the output retention rate in region i—defined as the ratio of "imports from self" to total shipments.[9] As the retention rates are less than one and tend to decline over time in both countries, the trade integration measure we will use generates a downward bias in the estimates of the level and growth of trade integration between two regions.[10]

7. For details, see Rupnik (1999).
8. Similarly, for purposes of analyzing the constituent parts of the overall integration measure, or carrying out analyses of region-specific impacts that focus on the trade integration of a region with another (as opposed to overall trade integration between the two regions), export and import intensities can be estimated by (m_{ij}/y_{ii}) and (m_{ji}/y_{ii}) for region i, and (m_{ij}/y_{jj}) . (m_{ji}/y_{jj}) for region j.
9. We would like to thank Keith Head for the suggestion.
10. For the period from 1980 to 1999, the retention rate in a median industry declined from 0.94 to 0.87 in the United States and it declined from 0.86 to 0.48 in Canada.

4. *Data sources*

Our analysis requires panel data involving detailed industries at the regional level. We have constructed a unique annual database covering the period from 1980 to 1999 that is comprised of 106 manufacturing industries at the 3-digit level of aggregation according to the Canadian Standard Industrial Classification (SIC). Our five regions include Atlantic Canada (i.e., the provinces of Newfoundland and Labrador, Nova Scotia, Prince Edward Island and New Brunswick), Quebec, Ontario, the Prairies (i.e., Manitoba, Saskatchewan and Alberta) and British Columbia. As shown in Table 1, most manufacturing activities are in the Central Canada, with Ontario accounting for about half of total shipments and Quebec for one quarter of total shipments.

Table 1 Regional and provincial shares of manufacturing shipments, percentage shares for selected years

Region and province	1980	1988	1999
Atlantic Canada	4.98	4.27	3.94
Quebec	26.54	24.43	23.52
Ontario	48.97	53.14	54.87
Prairies	10.03	9.53	10.38
British Columbia	9.48	8.62	7.30

Source: Annual Survey of Manufactures, Statistics Canada.

Our database includes, for each Canadian region, information on industry imports from, and exports to the United States, as well as industry detail on real value-added, the number of workers, net capital stock and labour productivity (real value-added per worker). Because we will be calculating regional industrial shares of North American production, we also include industry-level manufacturing shipments.

These data are obtained from a number of sources. Canadian import and export data come from the International Trade Division of Statistics Canada.[11] Canadian data on manufacturing shipments, real value-added, and the number of workers were obtained from Statistics Canada's Annual Survey of Manufactures. Canadian capital stock data were acquired from the Investment and Capital Stock Division of Statistics Canada.

We also require U.S. data. In particular, we need similarly detailed U.S. industry data on their imports and exports to the world, and as well detailed U.S. industry manufacturing shipments data. U.S. industry data on exports and imports for the 1980 to 1986 period are available according to the 1970 U.S.-Standard Industrial Classification (SIC), whereas data covering the 1986 to 1999 period are based on the 1987 U.S.-SIC. In order to obtain U.S. trade data that are

11. The division collects data on imports and exports by commodities and aggregates the data to SIC industries using a concordance between commodity and industry classifications.

comparable to the 3-digit Canadian-SIC data, we used a 1970 and 1987 SIC concordance from the National Bureau of Economic Research (NBER) to join together data from the 1980 to 1986 and 1986 to 1999 periods at the 4-digit U.S.-SIC (1987) level of aggregation. We then aggregated the 4-digit U.S. data into 106 industries aligned with the 1980 Canadian-SIC.[12]

Similarly, the U.S. industry data on manufacturing shipments were obtained at the 4-digit U.S.-SIC (1987) level from the NBER for the period from 1980 to 1996 and then extrapolated to the year 1999 using data on output from the U.S. Bureau of Labor Statistics. As with the trade data, we then aggregated the 4-digit U.S. data into 106 industries aligned with the 1980 Canadian-SIC.

5. *Empirical results*

In this section, we present empirical evidence on Canada-U.S. trade linkages in manufactures for individual Canadian regions. We focus on the aggregate measure of trade integration in manufactures with the United States.[13] We also examine the impact of growing Canada-U.S. trade integration on Canada and its regions in terms of productivity, output and employment growth, and shares of total North American production.

5.1 Canadian regions' trade integration with the United States

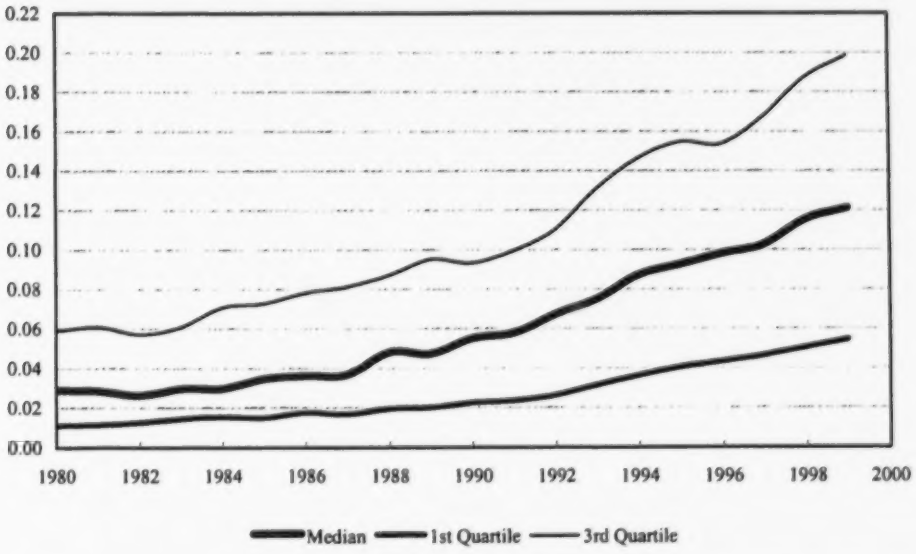
We calculated annual indices of trade integration between Canada and the United States at the regional and industrial levels over the period 1980 to 1999. These results support the view that the implementation of the FTA and NAFTA contributed to an increased pace of trade integration between the two countries during the 1990s.

Figure 1 shows the index of trade integration for three quartiles of one hundred and six 3-digit industries over the period 1980 to 1999. During that period, all three quartiles display large increases in trade integration between Canada and the United States. The degree of trade integration more than tripled in the 1990s relative to the 1980s. Between the 1980-1988 and 1988-1999 periods, the growth in the median value of trade integration increased from 0.002 per annum to 0.007 per annum.

Values of the trade integration index for total manufacturing between Canadian regions and the United States are presented in Figure 2. The value in a region is estimated as a weighted average of national 3-digit industry-level trade integration values, using regional industry employment as weights. Annual changes in trade integration measures for Canadian regions for the two periods, 1980 to 1988 and 1988 to 1999, are displayed in Table 2.

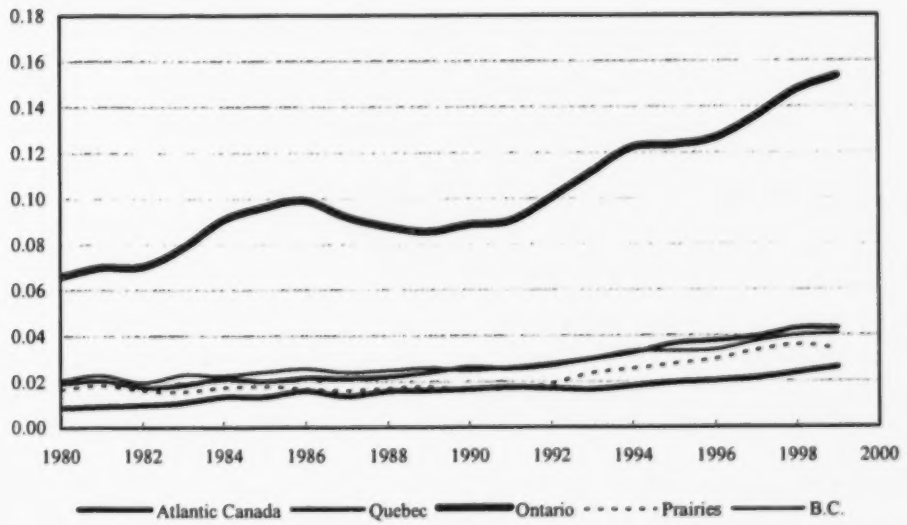
12. There are 110 Canadian manufacturing industries at the 3-digit level. We have removed four industries for which some data are not available. These four industries are: Coffin and Casket Industry (SIC 258), Combined Publishing and Printing Industries (SIC 284), Machine Shop Industry (SIC 308) and Ready-Mix Concrete Industry (SIC 355).
13. Further research will be required to investigate and compare results focusing on constituent parts of the overall measure, and importance of one-way trade integration, as measured by export or import intensities.

Figure 1 Index of Canada-U.S. trade integration in total manufacturing industries



Source: Index calculated by authors based on the Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

Figure 2 Index of trade integration between Canadian regions and the United States



Source: Index calculated by authors based on the Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

Table 2 Regional trade integration with the United States for total manufacturing, annual changes

Region	1980 to 1988	1988 to 1999	1988 to 1999 minus 1980 to 1988
Index of trade integration			
Atlantic Canada	0.0009	0.0009	0.0001
Quebec	0.0004	0.0019	0.0015
Ontario	0.0027	0.0060	0.0032
Prairies	0.0000	0.0016	0.0015
British Columbia	0.0005	0.0015	0.0009
Import/shipment ratios			
Atlantic Canada	0.0014	0.0060	0.0046
Quebec	-0.0047	0.0025	0.0072
Ontario	0.0008	0.0275	0.0267
Prairies	-0.0174	0.0098	0.0272
British Columbia	0.0005	0.0152	0.0147
Export/shipment ratios			
Atlantic Canada	0.0049	0.0185	0.0136
Quebec	0.0023	0.0207	0.0184
Ontario	0.0064	0.0214	0.0150
Prairies	0.0037	0.0171	0.0134
British Columbia	0.0030	0.0214	0.0185

Note: The integration index for total manufacturing is calculated as an employment-weighted average of integration indices based on 3-digit Canadian Standard Industrial Classification industries.

Source: Index calculated by authors based on the Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

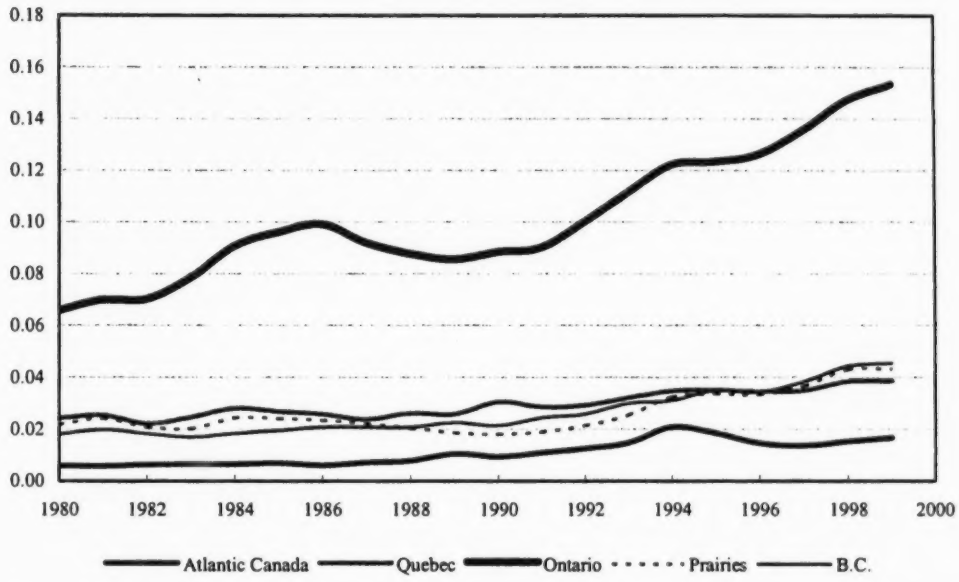
A number of findings emerge. First, integration between Ontario and the United States during the period is much greater than that between the United States and the rest of Canada. Atlantic Canada was least integrated with the United States, while Quebec, the Prairies and British Columbia were in the middle.[14]

Second, all Canadian regions have become more integrated with the United States. The increase in trade integration was fastest in Ontario, followed by Quebec and British Columbia. Atlantic Canada and the Prairies had the slowest growth in trade integration with the United States.

Third, the pace of trade integration was faster after the implementation of the Canada-U.S. FTA in 1989 for all Canadian regions. This post-FTA acceleration in the pace of integration was largest in Ontario. Atlantic Canada showed the slowest increase in integration with the United States during the post-FTA period.

14. Size and distance are important considerations when measuring two-way trade integration, and are explored in some details in Gu and Sawchuk (2001). Ontario is by far the largest Canadian province, economically-speaking, and is close to key U.S. markets.

Figure 3 Index of trade integration between Canadian regions and the United States, weighted using employment shares in Ontario



Source: Index calculated by authors based on the Annual Survey of Manufacturers and import and export data from the International Trade Division of Statistics Canada.

We then decomposed the inter-regional difference in changes in trade integration in manufactures with the United States into two main parts: that attributable to differences in regional export growth and that due to differences in regional import growth. For this purpose, we have calculated the ratio of imports or exports to total shipments for total manufacturing in a region as a weighted average of the ratio at 3-digit industry-level national output weights. The results, as shown in Table 2, suggest that most of the regional differences in the pace of trade integration with the U.S. are due to differences in import growth. For the period from 1988 to 1999, the import/shipment ratio increased the most in Ontario, and the least in Atlantic Canada. In contrast, changes in export/shipment ratios are similar across Canadian regions.

The inter-regional difference in trade integration in manufactures with the United States also reflects differences in industry mixes for the various regions as well as differences in the degree of trade integration facing the same industries in different regions. To examine the relative importance of these two components, we re-calculated the integration index by aggregating regional trade from the 3-digit SIC level, using industrial employment in Ontario for weights. As shown in Figure 3, the aggregate index thus calculated is similar to the indices shown in Figure 2 when weights were based on the industrial employment in each specific region. This suggests that regional differences in trade integration in manufactures with the United States are mostly due to industries being differently integrated with the United States across regions, as opposed to regions just having dissimilar industrial structure in manufacturing. Clearly, industry-level trade integration is not the same across regions and the use of national findings could result in biased estimates of the regional impacts of trade integration.

5.2 *Labour productivity growth*

To examine the impact of trade integration on labour productivity, we use a panel specification.[15]

$$(6) \qquad \Delta \ln lp_{is} = \alpha_i + \beta_s + \gamma_1 \Delta \tilde{\phi}_{is} + \gamma_2 \Delta \ln kl_{is} + \varepsilon_{is},$$

where $\Delta \ln lp_{is}$ is the annual log difference in labour productivity of industry i during period s, $\Delta \tilde{\phi}_{is}$ is annual change in the trade integration index in a period, $\Delta \ln kl_{is}$ is annual log difference in capital/labour ratio, and α_i and β_s industry and period fixed-effects.

We have included an industry fixed-effect α_i in equation (6) to account for the fact that declining industries tend to have a slow pace of trade integration for political economy reasons. We have also included a period fixed-effect β_s to allow for the difference in industrial productivity growth between periods.

Using annual data for one hundred and six 3-digit industries, we focus our analysis on the two sub-periods, 1980 to 1988 and 1988 to 1999. The year 1988 represents the point in time when the pace of trade integration between two countries became faster.

Let $s = 1$ index the FTA period from 1988 to 1999 and $s = 0$ index the pre-FTA period from 1980 to 1988. Differencing (6) across periods yields our difference-in-differences specification:

$$(7) \qquad (\Delta \ln lp_{i1} - \Delta \ln lp_{i0}) = \beta + \gamma_1 (\Delta \tilde{\phi}_{i1} - \Delta \tilde{\phi}_{i0}) + \gamma_2 (\Delta \ln kl_{i1} - \Delta \ln kl_{i0}) + \upsilon_i,$$

where $\beta = \beta_1 - \beta_0$.

It should be noted that labour productivity in this paper is defined as real value added per worker and is estimated from a sample of manufacturing plants from the Annual Survey of Manufactures (ASM). There are a number of differences between this measure and the official estimate from Statistics Canada. First, we use the number of workers from the ASM to measure labour input, while the official estimate uses hours worked that is estimated by multiplying employment from the ASM by the average annual hours worked from the Labour Force Survey. Second, we focus on manufacturing plants, while the official measure includes head offices and other auxiliary units. Third, we have removed printing and publishing (SIC 283 and 284) from the manufacturing sector, since these industries are classified as belonging to the service sector according to NAICS (North American Industrial Classification System).[16]

15. This specification is similar to the one used by Trefler (2004) to examine the impact of the FTA on industrial and plant performance.
16. Despite these differences, the two measures show a similar trend. The official measure shows that labour productivity in the manufacturing sector grew at a rate of 2.36% per year and our measure shows that it grew at a rate of 2.11% per year.

Table 3 Labour productivity growth, annual percentage change

Region and Canada	1980 to 1988	1988 to 1999	1988 to 1999 minus 1980 to 1988
Atlantic Canada	0.86	2.86	2.00
Quebec	1.10	2.45	1.35
Ontario	1.71	3.02	1.30
Prairies	1.28	1.66	0.38
British Columbia	2.48	0.48	-2.00
Canada	1.55	2.52	0.97

Source: Authors' compilation based on the Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

Table 3 shows the annual growth in Canadian and regional industrial labour productivity over the 1980 to 1988 and 1988 to 1999 periods (this is also shown in Figure 4). For Canadian manufacturing as a whole, average annual labour productivity growth increased 1.55% during the 1980 to 1988 period, and rose to 2.52% during the 1988 to 1999 period. This post-1988 acceleration was pervasive across all Canadian regions with the exception of British Columbia. For B.C. manufacturing, labour productivity growth showed a large decline during the 1990s. Figure 5 shows quite a strong link between a post-1988 acceleration in labour productivity growth and an acceleration in the growth of trade integration across Canadian manufacturing.

Table 4 reports estimates of Equation (7) from a sample of 3-digit Canadian manufacturing industries.[17] The results in column (1) show that the relationship between increases in the trade integration index and high labour productivity growth are statistically significant at the 5% level.

Table 4 Regression results for labour productivity growth

	(1)	(2)
Change in trade integration	1.996*	1.999*
	(2.54)**	(2.55)**
Change in log of capital/labour ratios	...	0.105
	...	(1.32)
Constant	-0.005	-0.006
	(-1.04)**	(-1.17)**
R Squared	0.055	0.072

... not applicable

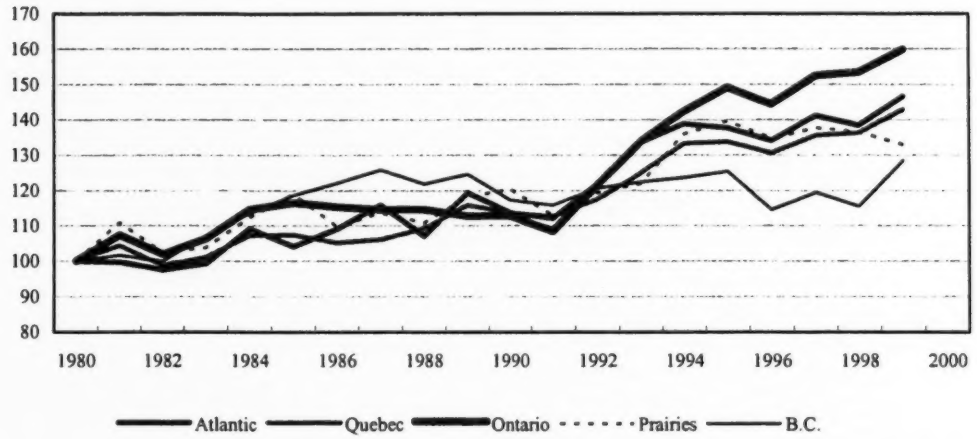
* Significant at the 5% level

** Heterosckedasticity-consistent t-ratios are in parentheses

Source: Canadian capital stock data from the Investment and Capital Stock Division of Statistics Canada.

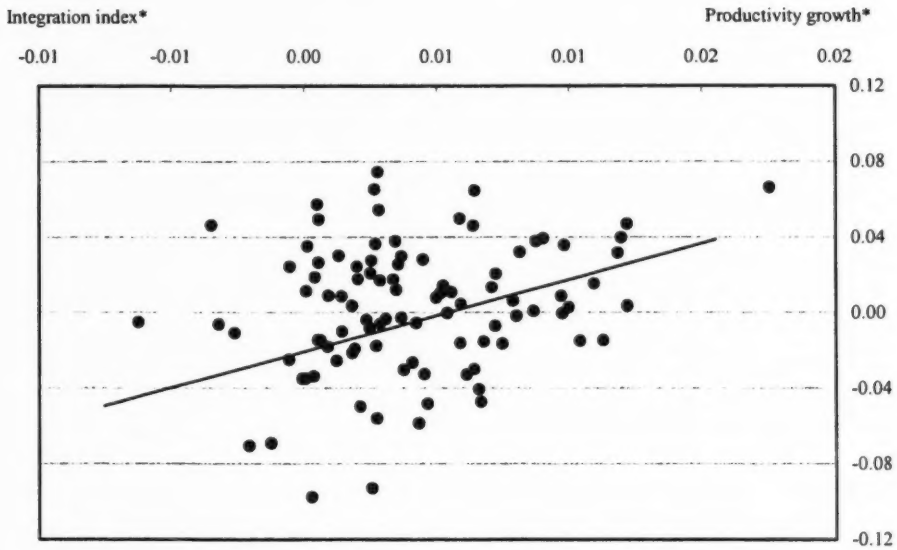
17. We have removed seven industries for our estimation that are shown to be outliers using the hadimvo procedure in the Stata software program. The resulting estimation sample consists of 99 3-digit industries.

Figure 4 Labour productivity in total manufacturing across Canadian regions



Source: Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

Figure 5 Scatter plot of labour productivity growth against changes in trade integration



* post-1998 change in integration index and in productivity growth
Source: Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

Due to a lack of data on capital stock, most previous studies have focused on labour productivity growth for Canada. For example, Trefler (2004) works with 4-digit SIC data, a level of industry detail at which capital stock data is not available. By working with 3-digit industries, we can take advantage of capital stock information to examine the association of both labour productivity and MFP to regional trade integration in manufactures with the United States. In column (2) of Table 4, we control for growth in the capital/labour ratio. The estimated coefficient on the trade integration variable is virtually unchanged and remains statistically significant at the 5% level. This suggests that deepening trade integration is linked to strong MFP growth.

Most previous studies on the impact of trade on industrial productivity use the ratio of trade to shipments as the measure of trade integration (e.g., Baldwin and Caves, 1997). When we re-run regression (7) using this alternative measure, we find that the coefficient on the variable is positive and significant at the 5% level.[18] However, the overall fit of the model is much lower. The R-square is about 35% lower for the regression run without the capital/labour ratios, and it is 25% lower for the regression that includes the capital/labour ratios.[19]

Table 5 presents the estimated impact of deepening trade linkages on labour productivity growth for Canadian regions.[20] The manufacturing sector in Ontario exhibited larger gains in labour productivity from deepening trade integration with the United States than did other Canadian regions. Actually, the gains in other Canadian regions were quite small. This was true for both the 1980 to 1988 and 1988 to 1999 periods. For instance, our results show that the deepening trade integration with the United States explained 1.2 percentage points or 40% of the 3.0 percentage-point increase in annual labour productivity in Ontario's manufacturing over the 1988 to 1999 period. During that same period, trade integration led to a 0.4 percentage-point increase in annual labour productivity growth in Quebec, a 0.3 percentage-point increase for Western Canada, and a 0.2 percentage-point increase for Atlantic Canada. The estimated impact on regional MFP growth is identical to the impact on labour productivity.

The regional differences in productivity gains from deepening trade integration can be decomposed into contributions from differences in industry mix and from differences in industrial trade integration between regions. The results in Table 6 show that most of the differences in productivity gains between Ontario and other Canadian regions are due to differences in the pace of trade integration of individual industries. Very little regional difference in productivity gains from deepening integration is due to differences in industry mixes across the regions. This is analogous to our earlier finding that showed how inter-regional differences in trade integration in manufactures with the United States are mostly due to the same industries being differently integrated with the United States across regions, as opposed to regions just having dissimilar industrial structures in manufacturing.

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18. The estimated coefficient is 0.246 without control for the capital/labour ratio and is 0.239 when we control for the capital/labour ratio. Both are statistically significant at the 5% level.
19. This finding is consistent with the argument that our trade integration index, which is derived from a model of trade in differentiated goods, appears to be more appropriate for examining the impacts of trade integration on industrial performance than other more traditional but seemingly more ad hoc measures.
20. It is estimated by multiplying the coefficient estimate on the trade integration index by the changes in the employment-weighted integration index in a region's total manufacturing sector.

Table 5 The estimated impact of trade integration on labour productivity growth, annual percentage change

Region	1980 to 1988	1988 to 1999	1988 to 1999 minus 1980 to 1988
Atlantic Canada	0.18	0.18	0.02
Quebec	0.08	0.38	0.30
Ontario	0.54	1.20	0.64
Prairies	0.00	0.32	0.30
British Columbia	0.10	0.30	0.18
Canada	0.31	0.80	0.49

Source: Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

Table 6 The sources of regional differences with Ontario in impacts of trade integration on productivity growth

	Overall difference	Structural effect	Other
		1988 to 1999	
Atlantic Canada	-1.02	0.01	-1.03
Quebec	-0.82	0.15	-0.97
Prairies	-0.88	-0.10	-0.78
British Columbia	-0.90	-0.15	-0.75
		1980 to 1988	
Atlantic Canada	-0.36	0.14	-0.50
Quebec	-0.46	0.04	-0.50
Prairies	-0.54	0.04	-0.58
British Columbia	-0.44	0.04	-0.48

Note: The differences are expressed relative to Ontario.

Source: Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

Table 7 The estimated impact of trade integration on real wage growth, annual percentage change

Region	1980 to 1988	1988 to 1999	1988 to 1999 minus 1980 to 1988
Atlantic Canada	0.04	0.04	0.00
Quebec	0.02	0.09	0.07
Ontario	0.12	0.27	0.15
Prairies	0.00	0.07	0.07
British Columbia	0.02	0.07	0.04
Canada	0.07	0.18	0.11

Source: Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

Part of the productivity gains from the increased trade integration is passed on to workers in the form of higher wages. When we estimate Equation (7) for real worker wage growth, we find that the coefficient estimate on the trade integration variable is 0.452, with a standard error of 0.241. Using this estimate, we calculated the impact of increased trade integration on real wage growth for Canada and its regions, as shown in Table 7. We find that workers in Ontario gained the most from increased trade integration. However, the gains in other regions were rather small. Over the 1988 to 1999 period, increased trade integration raised real wages of manufacturing workers by 12.0% for Ontario, but only 1.0% for Quebec, 0.8% for Western Canada, and 0.4% in Atlantic Canada.

5.3 Growth in output and employment

To examine the impact of trade integration on industrial real value-added and industrial employment, we use a double-difference specification similar to the one for productivity growth

$$(8) \qquad (\Delta \ln y_{i1} - \Delta \ln y_{i0}) = \beta + \gamma_1 (\Delta \tilde{\phi}_{i1} - \Delta \tilde{\phi}_{i0}) + \upsilon_i ,$$

where $\Delta \ln y_{is}$, $s = 0,1$ denotes annual log difference in industrial value-added or industrial employment during period s.

Table 8 presents the estimates of Equation (8) for the sample of 3-digit Canadian manufacturing industries. The coefficient on the integration variable is positive and significant at the 10% level for the output growth regression. However, the coefficient is not statistically significant for the employment growth regression. These results suggest that deepening trade integration is linked to high industrial output growth. But it is not related to industrial employment growth.

Recent empirical studies have concluded that declining trade barriers and deepening trade integration often involve adjustment costs in the form of a decline in industrial employment. Over the 1988 to 1993 period, about 300,000 jobs disappeared from Canadian manufacturing

plants—this is 1 in 6 manufacturing jobs. Trefler (2004) attributed a large portion of this loss to the Canada-U.S. FTA, implemented in 1989.

Our results support the view expressed in Trefler (2004) and Sawchuk and Trefler (2002) that these adjustment costs are short-run in nature. By 1999, employment in Canadian manufacturing had already bounced back to that in 1988. By using a longer period (1988 to 1999) than that in Trefler (2004) and Sawchuk and Trefler (2002), our employment growth regression finds that deepening trade integration had no impact on manufacturing employment.

With respect to output, our results in Table 9 show that increased trade integration was linked to annual increases in real value added for Ontario manufacturing that totalled 11.1% over the 1988 to 1999 period. For other regions, the impact was much smaller, measuring 3.5% for Quebec, 2.9% for the Prairies, 2.8% for British Columbia, and only 1.8% for Atlantic Canada.

Table 8 Regression results for growth in value added and employment

	Value added	Employment
	(1)	(2)
Change in trade integration	1.689*	-0.285
	(1.85)***	(-0.35)***
Constant	-0.011**	-0.007
	(-2.04)***	(-1.35)***
R Squared	0.028	-0.001

* Significant at the 10% level
** Significant at the 5% level
*** Heterosckedasticity-consistent t-ratios are in parentheses
Source: Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

Table 9 The estimated impact of trade integration on real value-added growth, annual percentage change

Region	1980 to 1988	1988 to 1999	1988 to 1999 minus 1980 to 1988
Atlantic Canada	0.15	0.16	0.01
Quebec	0.06	0.32	0.26
Ontario	0.46	1.01	0.54
Prairies	0.01	0.26	0.26
British Columbia	0.09	0.25	0.16
Canada	0.26	0.67	0.41

Source: Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

5.4 Canada's share of North American shipments

This section focuses on Canada and each of its regions within the context of overall North American production. In particular, we examine the link between increased trade integration and changes in their share of total North American shipments. We again use a double-difference specification

$$(9) \qquad (\Delta shr(V)_{i1} - \Delta shr(V)_{i0}) = \beta + \gamma_1(\Delta\tilde{\phi}_{i1} - \Delta\tilde{\phi}_{i0}) + \gamma_2(\Delta shr(E)_{i1} - \Delta shr(E)_{i0}) + \upsilon_i,$$

where $\Delta shr(V)_{is}$ is annual change in Canada's share of shipments destined for the North American market from industry i during period s, $\Delta shr(E)_{is}$ is annual change in Canada's expenditure share of North American goods of industry i in the period, and $\Delta\tilde{\phi}_{is}$ is annual change in the trade integration index over the period.[21] This is a reduced-form specification derived from a more structured model found in Head and Ries (2001).

Our main interest is the coefficient γ_1 on the trade integration variable. Krugman's (1980) model of trade in differentiated goods with increasing returns to scale suggests that the coefficient should be negative. That is, a reduction in trade barriers or an increase in trade integration should be linked to a decline in Canada's share of North American shipments as firms relocate to the larger U.S. market and serve the small Canadian market through exports. Such relocation allows firms to save on trade costs and realize economies of large-scale production. This potential loss in Canada's share of North American shipments from increased trade integration has been an important concern for workers and policy makers in Canada.

Krugman's increasing returns trade model also predicts a "home market effect", that is, a large home market translates into a disproportionate share of output and a trade surplus, i.e., $\gamma_2 > 1$. As shown in Table 10 and Figure 6, there was a trend towards an increasing share of North American shipments from Canada and its regions during the last two decades. Canada's share of North American shipments increased from 8% to 10% for the period from 1980 to 1988. It continued to increase in the 1990s. All Canadian regions increased their shares of North American shipments in the 1980s and 1990s. Ontario exhibited the highest rate of expansion. Atlantic Canada and British Columbia displayed the lowest gains, while Quebec and the Prairies showed modest gains.

21. Canadian expenditures on North American goods consist of purchases of Canadian goods (Canadian shipments minus Canadian world exports) plus imports from the United States. Likewise, U.S. expenditures on North American goods consist of purchases of U.S. goods plus imports from Canada. To derive shipments to the North American market, we have subtracted exports to the rest of the world from overall shipments.

Table 10 Changes in share of North American shipments, annual percentage point change

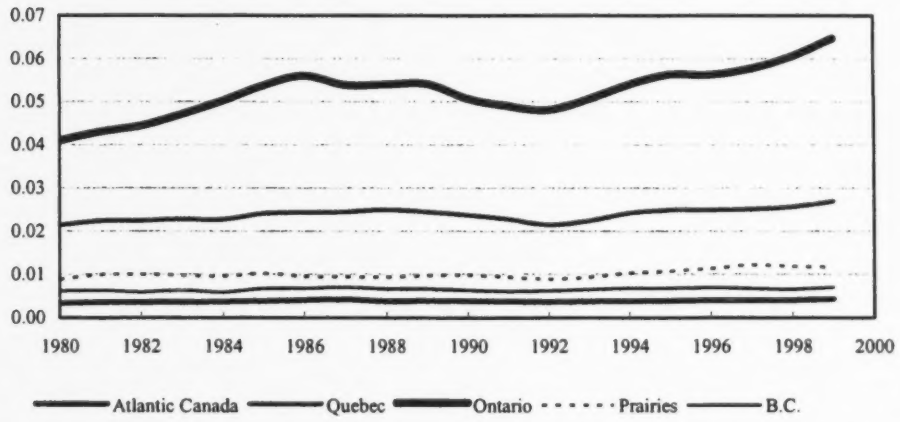
Region and Canada	1980 to 1988	1988 to 1999
Atlantic Canada	0.007	0.004
Quebec	0.044	0.018
Ontario	0.162	0.097
Prairies	0.007	0.021
British Columbia	0.007	0.003
Canada	0.227	0.144

Source: Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

This evidence is at odds with Krugman's model of trade with increasing returns. To further examine the link between trade integration and Canada's share of North American shipments in manufacturing, we have re-estimated Equation (9) using a panel of 3-digit manufacturing industries for two periods 1980 to 1988 and 1988 to 1999. The results in Table 11 show no evidence that Canada is losing its share of North American production as trade integration increases in North America. The coefficient on the integration variable is not statistically significant. The coefficient on the expenditure share variable is less than one and the difference is statistically significant at the 1% level.[22]

22. The t-statistics for the hypothesis that the coefficient differs from one is 21.33 using the specification in column (3).

Figure 6 Canadian regional share of North American shipments in manufacturing sector



Source: Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

Overall, our results stand in sharp contrast to Krugman (1980) who posits that $\gamma_1 < 0$ and $\gamma_2 > 1$. On the other hand, our results are consistent with those from Head and Ries (2001) who also find little support for Krugman's model of trade with increasing returns. What is more important, for the purpose of our paper, is our finding that Canada's share of North American production and that of its regions, in point of fact, increased during the last two decades.

Table 11 Regression results for share of North American shipments

	(1)	(2)	(3)
Change in share of North American expenditure	0.840* (25.48)**	... ...	0.844* (24.98)**
Change in trade integration	... ...	0.213 (1.51)**	-0.034 (-0.83)**
Constant	-0.000 (-1.26)**	-0.003 (-3.84)**	-0.000 (-0.26)**
R Squared	0.874	0.091	0.876

... not applicable

* Significant at the 1% level

** Heterosckedasticity-consistent t-ratios are in parentheses

Source: Annual Survey of Manufactures and import and export data from the International Trade Division of Statistics Canada.

6. *Conclusion*

This paper relates to two understudied, but increasingly important concerns: the measurement of regional integration, and the regional benefits to North American economic integration. The FTA and NAFTA provided Canada and all of its regions with better access to the large North American market. However, recent research for Canada on the impact of tariff reductions is incomplete by not addressing how widespread these resultant benefits are across regions, which can be crucial considerations in public policy debates.

Consequently, the objective of this study is to empirically measure trade integration in manufactures between Canada's regions and the United States, and to examine the regional impact of growing trade integration—specifically focusing on output and employment growth and productivity performance. We also examine how increased trade integration has impacted on Canada's share of North American production, and those shares of individual Canadian regions.

Our research shows that Canada and each of its regions are becoming more integrated in trade in manufactures with the United States—but Ontario is much more integrated than is the rest of Canada. Atlantic Canada is the least integrated, while Quebec and Western Canada are in-between. We find that this is mostly due to individual industries across regions being differently integrated with the United States, as opposed to regions just having dissimilar industrial structure in manufacturing.

For Canada and all of its regions, the pace towards deeper integration with U.S. manufacturing was faster after the implementation of the FTA. Again, however, the pace has been much faster in Ontario. When we decompose changes in trade integration into changes in import and export intensities, we find that differences in import growth have been the main source of regional difference in the pace of trade integration with the United States. Changes in regional exports (relative to total shipments) are similar across the regions.

While all regions have benefited from deepening trade linkages with the United States, Ontario has been the principal beneficiary. Our calculations show that deepening trade integration with the United States was associated with a higher multifactor productivity (MFP) of 1.2% per year for manufacturing in Ontario over the 1988 to 1999 period. In other regions, the impact is rather small—higher manufacturing MFP of 0.4% per year for Quebec, 0.3% for Western Canada and 0.2% for Atlantic Canada. The story is similar for labour productivity growth.

Our analysis suggests that part of these productivity gains was passed on to workers in the form of higher wages. When we calculated the impact of increased trade integration on real wage growth, we find that workers in Ontario gained the most from increased trade integration. The gains in other regions, although significant, were relatively minute. Over the 1988 to 1999 period, increased trade integration raised real wages of manufacturing workers by 12.0% for Ontario, but only 1.0% for Quebec, 0.8% for Western Canada, and 0.4% in Atlantic Canada.

Our analysis further shows that manufacturing output growth for Ontario was strongly linked to increased trade integration in manufactures with the United States. Increased trade in manufactures with the United States was associated with annual increases in Ontario's real value

added in manufacturing that totalled 11.1% over the 1988 to 1999 period. For other regions, the impact was considerably less—measuring 3.5% for Quebec, 2.9% for the Prairies, 2.8% for British Columbia, and only 1.8% for Atlantic Canada. No evidence was found that increased trade integration in manufactures with the United States caused anything more than short-run adjustment losses in employment. Indeed, by 2001, manufacturing employment had already bounced past pre-FTA levels.

Canada and each of its regions have expanded their share of North American manufacturing during the 1980s and 1990s, with Ontario's share increasing the fastest, followed by modest increases for the Prairies and Quebec, and smaller gains by British Columbia and Atlantic Canada. Overall, these results stand in sharp contrast to the supposition that it would be the United States that would experience a growth in North American production share (Krugman, 1980).

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